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OBSERVATIONS

ON THE PRESENT STATE OF THE

ART of NAVIGATION,

WITH

a short account of the nature and regulations of a SOCIETY now forming for its EFFECTUAL IMPROVEMENT.

By JAMES FERGUSSON.

L O N D O N :

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1787.

To

The Honorable Corporation of the Trinity House

This little essay

is, with all possible respect, humbly presented

by

The Author.



TO THE
Mariners of Great Britain in General,

WHETHER EMPLOYED IN HER
P R O T E C T I O N,
O R
C O M M E R C E,

THIS SMALL ATTEMPT TOWARDS THE
IMPROVEMENT OF THE NAVAL ART,
AND POINTING OUT THE ONLY MEANS
TO EFFECT IT, BY MAKING THEM-
SELVES THE HAPPY INSTRUMENTS,

I S,
WITH THE UTMOST RESPECT,
DEDICATED

Stepney,
Oct. 15, 1787.

B Y
The AUTHOR.



OBSERVATIONS

ON THE PRESENT STATE OF THE

ART of NAVIGATION.

THERE scarce ever was a time in this country, when improvements in every part of the art of Navigation were so eagerly desired by our Mariners, as at present ; and that with just reason : the few lights that Science has lately thrown upon it, have been found so useful in the speedy and exact conducting of our ships from port to port, that it is no wonder we should ardently wish for an increase of that, which experience has proved to be so beneficial.

But it is a difficult matter, when we look towards improvement in this art, to know where to begin : every part of it is, more or less, defective, as we may quickly perceive, whether we turn our eyes towards

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our books, our instruments, our charts, our ships, or the methods of conducting them across the ocean. In the first, our mariners, at least too great a number of them, either from want of the necessary knowledge to judge for themselves, or from an indifference that does them no credit, blindly depend upon writers, whose names are all they know of them; but whose abilities, and the merit of whose performances, they are utter strangers to. This gives every impudent pretender courage to offer his book, or chart, as the most perfect work of its kind, though the very patterns of ignorance and error; whereas, should all those works be obliged to undergo the examination of proper judges, and carry the mark of their approbation before they were brought into common use, the mariner would be safe; and knavish impostors no longer boast of the profits they make of the seaman's credulity, but employ their talent where less liable to detection.

As to books of tables, the execrable and dangerous errors they swarm with, and
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which they have swarmed with for a long time past, have doubtless been the real occasion of the loss of many a ship, which its officers have constantly attributed to other causes : for none of them would presume to think, that he who was capable of writing a book containing *the whole Art of Navigation*, as many ridiculously call their compilations, could be either so ignorant, or so careless, as to suffer a mistake to enter into it that could be of any consequence. Yet nothing is more true : traverse tables have been published, where one column has been set in the place of another ; and the tables of declination have been from 5 to 40 minutes wrong, and even more ; nay, some have been one continued blunder from end to end.

An intelligent mariner may easily judge of the fatal effects of such books, when implicitly trusted to, as is but too often the case ; and even now, if the declination tables are better than they formerly were, we have to thank the publishers of the Nautical Almanac, which book furnishes so rich a fund to steal from, and so

easy to come at, without the trouble of calculation: but, as all robbers are not acquainted with the value and use of the treasure they have stolen, and are generally careless enough of what is so easily come by, it is yet doubtful how far such surreptitious tables are true; for ignorance and carelessness will spoil the most correct work; and it is not the first time that “the 3d after leap-year,” has been found over a table of declination calculated for leap-year itself: a blunder, from which, supposing all the rest of the table to be true, near 18 minutes of error in latitude would arise, from observations made near the equinoxes; and to such errors, therefore, of the mercenary publishers of nautical tables, (and which plainly show how much they are in want of a proper check upon them) we may justly impute, as I have already observed, many of our losses, and perhaps the greatest part of the accidents and mistakes that daily happen, even to experienced seamen, in falling in with the British channel.

In our instruments, logs, glasses, compasses, and quadrants, there are likewise
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numberless errors and imperfections, some in the nature of the instrument itself, others in the execution, and very commonly in both. Few mariners are acquainted with the principles of their instruments ; and where they are not, they have no dependance but on the skill and integrity of the maker, which are not generally found sufficient to trust a ship, her cargo, and the lives of her company upon. In many cases improved instruments of all the above kinds, and new ones that are yet wanting to navigation, are much to be desired ; even Hadley's quadrant itself, however excellent it may be in taking altitudes at sea, would quickly give place to another, that would separate from those observations the irregularity of the position of the horizon ; or that, without its inconvenience, would take the lunar distances to as great a degree of exactness.

Time was, and that not many years ago, when the now almost forgotten Davis's quadrant was the universal instrument, amongst the most experienced seamen ; and its fore-runner, the cross staff, was then in
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as little use as the Davis is now: yet these were considered, at the time of their invention, as admirable improvements on former instruments; nay, the inventor of the first of these, though far inferior to that afterwards called Davis's quadrant, was proud of it, even to folly, and publickly maintained it to be the best altitude instrument a seaman *could find*, both for ease and accuracy. How much it is outdone in both, by the Hadley's quadrant, every artist can tell; and we have no reason to doubt but that the time may come, when some new principle will be applied to this purpose, which may produce an instrument as far superior to the Hadley, as that is to those which preceded it. The encouragement given to naval productions in the present hour, is enough to excite every ingenious mind to direct its speculations to nautical improvements.

As to the other instruments, those employed in affording us our common reckoning, are below contempt; and when we have said there is not an *azimuth* compass to be depended upon within a degree even on shore,

shore, much less when employed at sea, in a moveable observatory such as a ship, it is presumed no more need be said about the necessity for better compasses. All the theories of magnetic variation depend on the truth and delicacy of such observations ; and all the utility of variation charts is founded on the same precision : a small difference in the variation, frequently produces a great change in the longitude deduced from it, as any one may find who looks on such a chart, even where the magnetic curves are far from an east and west direction.

Our sea charts are perhaps the very worst instruments we are in possession of ; nor is there a more flagrant, or more pernicious abuse made of human credulity, than in this very instance : amongst the great number of them there is not one in twenty but deserves the fire. This is certain, that if mariners knew the principles on which many of these are constructed, they would soon become more cautious in the use of them. Most part laid down from very uncertain observations, and the rest from the mere imagination

gination of the draughtsmen, they are notwithstanding held forth as unerring guides ; and, indeed, to look at them, and mark the critical nicety that seems to be observed in giving every little break and turning to the coasts, the rocks, sands, soundings, and nautical observations, such as they are, so plentifully spread over them, we might be easily induced to believe that every part had been so exactly surveyed, as to leave no doubt of their correctness : but experience quickly informs us they are only pictures, the creatures of the brain ; and the numberless accidents that daily arise in trusting to such blind guides, might serve, one would think, to open the eyes of those that use them ; which would certainly be the case, but that there are so many imperfections, and so many causes of error in the present Art of Navigation, that a mariner scarce knows to which of them an accident is to be imputed.

Except in the surveys that have been made by national authority, and which are very costly, if at all to be come at, there are
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hardly 20 points in the whole Atlantic ocean that are exactly determined by astronomical observations, such as are proper to found a true chart upon ; yet there is not a paltry copier of one of these imaginary charts, but shall boldly tell you, his new production is founded on, and regulated by, astronomical observations, though he is absolutely ignorant of what observations are necessary to regulate a chart, nor how to use them when he has them : of these, daily instances occur to every proper judge of the subject. The same thing happens with respect to original surveys : such a one is no sooner published, and crowned with just reputation, than a wretched copy is made by some such ignorant bungler, who wants, however unlawfully, to share in its gains ; and as he justly reasons, that a bad copy cannot, properly speaking, be called a copy at all, he gives his piracy the pompous title of “A new and accurate Survey,” without fear of detection ; cunningly supposing that the unsuspecting mariner will think there could be no occasion for a *new* survey, if faults had not been found, by somebody, in the old one ; and

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that from this false reasoning, this self-imposition, the new one will be greedily bought up: which is but too commonly the case, in preference and prejudice to the originals, and to the discouragement of every industrious and ingenious artist.

Whatever improvements the mutual assistance of experiment and theory may have afforded in the art of ship-building, it is an acknowledged fact, that much remains to give it the requisite perfection. Nor need we wonder at this, when the doctrine of fluids, on which the proper figure of the solid of least resistance is dependant, is so little known: the principles, or laws, of bodies moving through them, as hitherto laid down, are egregiously false; and though experiments have furnished, lately, some light into this curious subject, many more are wanting before we shall be able to turn it to our present purpose. What is here said of the figure of ships, may as well refer to the working of them; the same doctrine being equally applicable as well as essential to both.

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Besides, an art is more or less perfect in proportion to its independance on the other arts. The principles of navigation are simple, just, and adequate ; but the data are subject to error, and consequently the conclusions. The various motions of the element through which a ship is conveyed, and several other causes, take from our estimation of course and distance, that precision which is wanted, and renders the use of astronomy, and the other arts, indispensable.

But if the causes of these errors are within the power of detection, or were we once so far made acquainted with the laws whereby they act, as to be able to make a proper allowance for their effects on the ship's run, the dead reckoning would no longer deserve such a name of contempt ; it would then become worth all the rest ; nay, it would render them all unnecessary, or cause them to be considered as mere auxiliaries, which now hold the place of pre-eminence. The mariner would then, by the simplest methods, be constantly in possession of the ship's true place ; not obliged to wait, as

now he must, from noon to noon, and often for weeks together, before the heavens afford him an opportunity of ascertaining it.

To accomplish this wished-for end, there is only required an exertion in the seamen themselves. If they would once join their endeavours, they would soon see the good consequence. This is certain, that the first step towards it, is to collect a great number of careful observations of different kinds, all of such a nature as can only be expected from mariners who spread over the whole ocean, and observe its phænomena at all seasons.

Mixt mathematics, of which this art is a branch, consist in the application of mathematical reasoning to the phænomena of nature, either as collected from occasional observations, or well-directed experiments. The facts which either of these furnish, when they have been once properly arranged and digested, serve as the data for establishing a hypothesis from which all other phænomena, arising from the same cause, may be investigated : this hypothesis is again corrected

rected by subsequent experiments, and so brought, by the alternate use of reasoning and experiment, gradually to its wished-for perfection.

Now, every effect must have some cause; and the combination of several causes, operating at the same time on the same body, will produce a complicated effect; to unravel which effect, all the operating causes must be taken into consideration; and this cannot be done without a number of experiments proportioned to the complication. The motions of air and water are of this nature; they are influenced by several causes, and therefore require a great number of observations before they can be subject to the mode of investigation just spoken of.

It is a just, though common observation, that patience and perseverance conquer all difficulties. The theory of the moon, though now brought to so high a degree of perfection, that we can point out her place in the heavens for any future time, to an almost perfect exactness, was formerly looked
upon

upon as so intricate, that it was supposed scarcely capable of investigation. The great number of nice observations it required, amounting to many thousands, seemed the work of ages ; yet one man, beginning this labour even in his old-age, lived to complete the whole number, and almost the theory itself : such is the effect of industry and application.

The observations necessary to establish such a theory of the motions of the air and water, as may be usefully applied to the purposes of navigation, may be even more numerous than those of the moon ; besides, it requires that those observations be made in every part of the ocean, to give the theory its necessary perfection ; for the phenomena are so different, in different parts of the world, that nothing less than actual observation could make us suppose it possible: we need only mention those of the periodical winds in the Indian ocean, and the tides in the South sea, compared with what our own climate exhibits, to prove the truth of this assertion.

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It is plain, therefore, that these observations must be obtained from the united efforts of mariners themselves ; efforts that cannot be long wanting, if the greatness and consequence of the object be attended to ; if it be considered that every labourer that lends his hand to this work, will be rewarded with the full effect proceeding from the joint exertions of the whole body ; that new and real lights will continually be afforded him, in every navigation, instead of those false ones that are now held out only to guide him to destruction ; and, finally, that he will have the honour of being an instrument in bringing his art to perfection, and thereby obtaining, by direct and easy methods, the place of his vessel on the ocean, and her truest, shortest, and safest line of direction to her intended port ; instead of the present laborious and intricate ones which he is now obliged to use, and which, notwithstanding, are far from certain.

But it would be in vain to make observations that were to remain solitary and neglected, which must be the case if there be
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not a common repository, where the labours of all may be jointly placed, and digested from time to time, by proper persons appointed for that purpose. We might then, from such a collection of observations as this great body would quickly furnish, soon be enabled to show the state of the atmosphere; the direction and force of the winds; the dip and variation of the magnetic needle; the rise and direction of the tides, the set and drift of currents and waves; the altitudes of the latter, &c. in all the different parts of the world, and at all seasons of the year. The latitudes and longitudes of numberless places now undetermined would be exactly ascertained; the soundings both on approach of land and often at a distance from it; together with new and occasional dangers discovered in the course of these several voyages, would be pointed out; whereby our charts might be corrected, the proper seasons for navigating different parts of the ocean more exactly known, and the great deficiencies supplied that are the opprobria of the present state of the art of navigation.

To

To accomplish this desirable end, it has been some time proposed to form a society, the first of its kind, though so long wanted, where naval knowledge will at length be placed in the proper train for improvement; where experiment will lead to truth, and disperse the errors of idle speculations and arbitrary impositions; where dangerous and unsuspected mistakes in books, &c. of common use will be detected and exposed, and the noble art of navigation derive as much glory from the sagacity and assiduity of Britons, as it has done from their dexterity and bravery.

A number of mariners, conscious of these truths, have therefore agreed to unite themselves under the name of the BRITISH NAVAL SOCIETY, to furnish all the helps in their power, and to join in whatever the body may consider as proper for accomplishing their design: and several gentlemen, eminent for their knowledge, learning, and situation in life, from a conviction of the utility of such an institution, propose to unite themselves to this society, and afford it their assistance. This example

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will no doubt be followed by every man who wishes well to Navigation and Commerce, but especially by professional men, whose very lives are dependant on the perfection of this art, and whose safety, ease, and preservation, are the ultimate ends for which this Society is now intended.

The general heads of this institution are as follow.

RULES

RULES and REGULATIONS

TO BE OBSERVED BY THE MEMBERS OF THE

BRITISH NAVAL SOCIETY,

Instituted for the Improvement of Nautical Knowledge.

1. **T**HAT this Society be composed of Mariners, and such other scientific Gentlemen as are lovers of naval science; that it do meet at such time and place as the majority shall appoint; and that the first meeting be

2. That at such meetings the papers communicated to the Society in the course of the week, or such part of them as the time will permit, shall be read; and such experiments exhibited, as any member of the Society may be pleased to introduce; or as may be directed, by the Society at large, to any proper person to prepare for their inspection.

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3. That

3. That no papers be read, but such as tend immediately to the purpose of this institution, which is entirely nautical, and that in the largest sense; but whose principal objects at present are, to perfect the dead reckoning; to improve naval books, instruments, and charts; to detect the errors of those in common use; to investigate the true principles on which the construction and manœuvre of ships depend; and such other particulars as make up the subject of the foregoing discourse.

4. That every member, on his admittance, pay into the hands of the Treasurer, the sum of One Guinea, and the like sum yearly, by two equal half-yearly payments, for the purposes hereafter mentioned; and make the following promise:

“ I, N. do solemnly promise, as far as
 “ in my power lies, to fulfil the object of
 “ this Society, in promoting and improving
 “ the art of Navigation, as well by the
 “ communication of my own observations
 “ and experiments, as of those which I can
 “ obtain

“ obtain from others, that I may judge
 “ likely to answer that purpose ; and also
 “ to make and keep an account of such ob-
 “ servations and experiments as may be re-
 “ commended to me, by this Society, to
 “ be made in the course of any of my
 “ voyages, as far as my business, abilities,
 “ and opportunity will permit.”

5. That the monies so raised, after pay-
 ing the necessary expences of house-rent,
 servants, &c. be applied to the furnishing a
 library, consisting of all the authentic
 charts, and surveys of coasts, &c. that have
 been made, and of which copies can be ob-
 tained ; of all the books of pilotage, hy-
 drography, voyages, and discoveries by sea,
 that are extant, (beginning with those of all
 kinds that are likely to be the most useful)
 together with all the naval histories extant,
 especially those of Great Britain ; and all the
 best treatises of the nautic art, from the
 building, to the conducting ships across the
 ocean ; with such other works as may tend
 to form a complete naval library fit for so
 noble a foundation.

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From such an acquisition, the ingenious Mariner will have it in his power to examine the truth of any particular chart, proper for his voyage, without being at the enormous expence which attends the purchase of original surveys, or large books of draughts, of which the greatest part are perhaps of no use to him; he will find all the hydrographical remarks that require his attention; and will by this assistance become acquainted, very often, with the means of making a timely, safe, and pleasant navigation, instead of one filled with dangers and perplexity: for, as it is meant to include the authentic books of foreign nations, as well as of our own, the library will very often furnish that kind of intelligence, which otherwise it would have been next to impossible to obtain.

6. That other part of the said monies shall be applied towards making such experiments, as shall from time to time be judged proper by the Society, for elucidating such part of this subject as may be obscure; demonstrating, or refuting, what is doubtful; and investigating what yet appears to be wanting.

7. That

7. That further part of such monies be applied to the printing and publishing, from time to time, such observations and improvements as may be offered by the members hereof, or any other persons, and which shall be adjudged by the President and Committee of Papers proper for publication; that each member be entitled to one copy of every such publication; and that the rest be disposed of, and the profits thence arising go into the fund, to be applied to the other necessary purposes.

8. That the members do meet annually, on the first Monday in October, to chuse a President, and persons as a Committee, to manage the business of the Society for the ensuing year.

9. That the President and Committee do chuse and appoint a proper person to be the Treasurer of the said Society, another to be Secretary and Librarian; together with such servants as may to them seem necessary.

10. That the Committee do resolve itself into such parts as may be the most effectual

effectual for managing the finances of this Society; considering the papers offered; examining the books and charts already published and most in use, and such as may hereafter be published; the same of nautical instruments; as also to determine what part of the Society's papers may be most proper for publication; and to point out the observations required of the several members, that are most likely to fill up the views of this Society; together with the proper methods of making such observations, when any thing different from those in common use.

11. That this institution being intended for the general good, the books shall be open to all subscribers; but that every subscriber who shall misbehave, or make any disturbance during the hours of meeting, shall be, *ipso facto*, expelled, and his subscription forfeited.

12. No non-subscriber to be admitted without leave of the President; nor the same person more than once, without paying his subscription.

13. That

13. That the Librarian do make out, and keep ready for the inspection of the members, a catalogue of the books, charts, &c. belonging to this Society; that he digest, and arrange in proper order, all such observations, journals, &c. as may from time to time be presented to this Society, and make report of their contents, especially of any new or extraordinary occurrence contained in them, on the ensuing and following nights of meeting.

14. That such parts of those communications as seem most immediately to fill up the views of this Society, be fairly copied by the Secretary, or other proper persons, into books prepared for that purpose, to be open for the inspection of the members of the Society, at all times when the library is open.

15. That every member, during the times, and under the rules and regulations prescribed by the Society, shall have free access to the books and papers contained in the library; that the Librarian attend to see

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due order preserved, and to point out, to any member that may require it, such books, &c. as the library contains, which may be useful to him in the prosecution of his present inquiry.

16. That none but members be admitted to peruse any of the Society's books or papers; nor any person allowed to take a copy of any manuscript belonging to the Society, without especial order, signed by the President, and six at least of the Committee.

17. That books be opened to receive the names, and address, of those Gentlemen who desire to become members of this Society, at the following places; Mr. RAMSDEN's, *Piccadilly*; Mr. ADAMS's, *Fleet Street*; Messrs. NAIRNE and BLUNT's, *Royal Exchange*; Messrs. GREGORY and WRIGHT's, *Leadenhall Street*; Mr. FERGUSSON's, *Stepney*; and at BAKER's COFFEE-HOUSE, *Change Alley*; and that nothing more be required towards admission, but an attendance on the subsequent night of meeting, and conforming with what is specified in article 4th.

18. That

18. That all subscription monies be paid to the Treasurer or Secretary, on the nights of meeting, who will give proper receipts for the same, and enter the names of the Subscribers in the register book of the Society.

19. That all presents of books, instruments, charts, &c. be duly registered, with the name and designation of the donor.

20. That the general rules and regulations here laid down, be considered as the standing rules of the Society, subject to such alterations only as shall be agreed upon by the President and the whole Committee for the time being.

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